COLORADO RIVER RECOVERY PROGRAM Project No.: 98a/125
FY-2004-06 PROPOSED SCOPE OF WORK
Middle Yampa northern pike and smallmouth bass control

| Note: Northern pike and smallmouth bass will be tagged with numbered yellow floy tags.

Lead Agency: Colorado State University

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Date[1]: 01/09/04, 01/22/04, 2/13/04 (2/17/04 by Pat Nelson)

Category:
__ Ongoing project
X Ongoing-revised project
__ Requested new project
__ Unsolicited proposal

Expected Funding Source:
X Annual funds
__ Capital funds
__ Other (explain)

I. Title of Proposal:

Evaluation of northern pike and smallmouth bass control in the middle Yampa River

II. Relationship to RIPRAP (April 2003 version @ http://www.r6.fws.gov/crrip/rip.htm)

Green River Action Plan: Yampa and Little Snake rivers

III Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

III.A.1. Implement Yampa Basin aquatic wildlife management plan in reaches of the Yampa River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continue as needed.

III.A.1.b. Remove and translocate northern pike and other sport fishes from the Yampa River.

[1] See last page for revision changes and dates.

III. Study Background/Rationale and Hypotheses

In the Yampa River, nonnative piscivorous northern pike *Esox lucius* and smallmouth bass *Micropterus dolomieu* are a predatory and competitive threat to native and endangered fishes. Northern pike have occupied the river for 25 years and smallmouth bass have occupied the river in significant numbers only in the last 10 years. Northern pike were stocked into the tributary Elkhead Reservoir in the late 1970's and escaped and colonized the Yampa River almost immediately. In addition to Elkhead Reservoir, northern pike now occur throughout the Yampa River and portions of the middle Green River, both upstream and downstream of the Yampa River confluence, and have self-sustaining populations in Stagecoach and Catamount reservoirs where they were illegally introduced.

Smallmouth bass were extremely rare in the Yampa River until 1992 (Modde and Smith 1995), when a rapid maintenance draw down at Elkhead Reservoir introduced large numbers of the species into the Yampa River where they are now abundant in reaches downstream from Elkhead Creek. The loss of fish from the reservoir was so great that local fishermen reported a significant decline in the smallmouth bass fishery in Elkhead Reservoir after the draw down. In the early 1980's, smallmouth bass were extremely rare (Wick et al.1985). Native fish numbers are now extremely low and the small-fish prey base has precipitously declined (Anderson 2000). This decline has been attributed to the invasion and abundance of piscivorous northern pike and smallmouth bass. Smallmouth bass are also considered food-resource competitors with Colorado pikeminnow due to their predation of small, prey-sized fish typically consumed by pikeminnow.

Both northern pike and smallmouth bass occupy reaches designated as critical habitat for the federally endangered Colorado pikeminnow *Ptychocheilus lucius*, razorback sucker *Xyrauchen texanus*, humpback chub *Gila cypha*, and bonytail *G. elegans*. Northern pike are known predators of wild Colorado pikeminnow and stocked razorback sucker and are presumed predators of humpback chub and recently reintroduced bonytail. Northern pike also pose a significant predation threat to other native species such as roundtail chub *G. robusta*, flannelmouth sucker *Catostomus latipinnis*, and bluehead sucker *C. discobolus* (Martinez 1995). Northern pike were rated the 3rd greatest nonnative species of concern by experts in the Upper Colorado River Basin based on the potential effects of pike predation on endangered and other native fishes (Hawkins and Nesler 1991). Smallmouth bass were ranked low on the list of species of concern but the ranking questionnaire was completed before their 1992 influx into the Yampa River. The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) determined that management actions to reduce abundance of nonnative piscivorous fish was necessary to recover endangered fishes in the Upper Basin. The Colorado Division of Wildlife (CDOW), a Recovery Program participant, developed an Aquatic Wildlife Management Plan for the Yampa River Basin (Yampa Aquatic Plan) that recommended managing the reach downstream of Craig, Colorado, for

native and endangered fishes by removing smallmouth bass *Micropterus dolomieu*, channel catfish *Ictalurus punctatus*, and northern pike. The Yampa Aquatic Plan recommended removal of these three species from the river and relocating them to other waters within the Yampa Basin to provide continued sport-fishing opportunities (CDOW 1998). Removing northern pike from critical habitat should temporarily reduce predation pressure on endangered fishes and reduce the influx of northern pike to downstream river systems. Reducing the abundance of smallmouth bass in the Yampa River should reduce predation pressure on native fish and increase forage for Colorado pikeminnow. This Scope of Work (SOW) is an evaluation of removal of northern pike and smallmouth bass in critical habitat of the Yampa River.

Knowledge gained from previous sampling

In 2003, we obtained population size and capture efficiency information for northern pike in a 75-mile reach, and smallmouth bass in a 12-mile reach, of the Yampa River. These statistics provide information useful in guiding management of nonnative fishes. Capture efficiency or capture probability is an estimate of the probability of an animal being captured on each sample occasion. Capture probability can be used to estimate how many sample passes are required to remove a portion of the population. For example, if fish are removed from a population of 1,000 fish on three sample passes and capture probability is 40% then 784 fish or 78% would be removed from the population.

> If the starting population contains 1,000 fish X 40% = 400 fish removed on pass 1, leaving 600 fish X 40% = 240 fish removed on pass 2, leaving 360 fish X 40% = 144 fish removed on pass 3, leaving 216 fish in the population.
> Total fish removed in 3 passes = (400+240+144) = 784 or 78%.

A simple formula to calculate the number of sample passes (N) required to remove a given percent of the population when capture probability is known is: $N = R / P$

where;
$R = \log(1-\%$ of population to be removed), and
$P = \log(1-$probability of capture).

To achieve a higher level of removal requires either improved techniques that increase the capture probability or increased effort. High capture probabilities are achieved with an experienced and well-trained field crew with knowledge of the species and area, using efficient capture gear and techniques, and sampling local high-density habitats repeatedly during each sampling pass. Increased effort is achieved by increasing the number of sample passes.

In 2003, the population size of northern pike was estimated at 565 fish (485–675, 95% CI) with a 21% probability of capture, which suggests that on an annual basis with adequate effort, it is feasible to remove a significant portion of northern pike within the

study area. Based on 2003 results, it will require at least five removal passes to increase removal and deplete 70% of northern pike in the study area. In 2003, the population of smallmouth bass in the 12-mile study reach numbered 5,121 fish (4,526–5,832, 95% CI). Capture probability was 6%. Smallmouth bass movement indicated that the 12-mile control-treatment study area was too small, because a large portion of smallmouth bass mixed between the 6-mile treatment and the 6-mile control reaches, yet recapture data identified that a large portion (90%) of recaptured fish remained within a 12-mile area. This led to the recommendation to increase the study reach from 12 to 24 miles to reduce mixing of fish between the treatment and control reaches. To remove a larger portion of smallmouth bass will require more than five removal passes. The five sampling passes in the study reach in 2003 would have removed only 23 % of the bass population. We estimate that to remove 45% of the smallmouth bass in the 12-mile removal reach in 2004 will require at least 10 removal passes.

IV. Study Goals, Objectives, End Product:

Northern pike
The goal is to remove as many pike as possible from critical habitat and estimate the fraction of the population removed.

Objectives

1. Obtain an estimate of the number of northern pike that reside in the 95-mile study reach in the Yampa River using a mark-recapture abundance estimator.

2. Remove a large portion of the estimated population of northern pike from the study reach during five removal passes.

3. Calculate the proportion of northern pike removed based on initial population size.

Smallmouth bass
The goal is to remove as many smallmouth bass as possible from a 12-mile treatment reach and a 5-mile concentration reach and estimate the fraction of the population removed from each reach.

Objectives:

1. Obtain an estimate of the number of smallmouth bass in the control and treatment reaches in Little Yampa Canyon and the 5-mile reach in Lily Park using a mark-recapture abundance estimator.

2. Remove a large portion of the estimated population of smallmouth bass from the 12-mile treatment reach in Little Yampa Canyon and the 5-mile concentration area in Lily Park.

3. Calculate the proportion of smallmouth bass removed from each study area based on initial population size and compare capture rates between control and treatment reaches.

4. Evaluate movement of tagged smallmouth bass from the control reach to ensure that immigration or emigration does not confound comparisons between control and treatment site.

V. Study area:

The northern pike study reach in the Yampa River is 95 miles long and is located between Craig, Colorado (River Mile, RM 140) and Yampa Canyon (RM 45). This is an expansion of 20 miles (26%) from previous years. The expanded area is between Craig and Milk Creek (RM 120). There are two smallmouth bass study reaches. One is located in Little Yampa Canyon between Round Bottom (RM 124) and near Government Bridge (RM 100) and is divided into a 12-mile control reach (RM 124–112) and a 12-mile treatment (removal) reach (RM 112–100). Another smallmouth bass study reach (5 miles long) is at the upper end of Lily Park between Cross Mountain Canyon (RM 56) and the Little Snake River confluence (RM 51).

Sampling Dates

Sampling will occur between April and July, during runoff. Spring runoff sampling is preferred to other seasons because higher flows allow river access and navigation and cool water temperatures allow easier and more successful transport of live fish. Northern pike and smallmouth bass are susceptible to electrofishing when they occupy shallow shoreline and flooded off-channel habitats.

VI. Study Methods/Approach

Three items have changed since 2003 sampling. The area of northern pike removal has increased 26% or 20 miles, smallmouth bass treatment and control areas have doubled in size from 6 miles to 12 miles each, and we will attempt to almost double the number of removal passes for each species. In order to increase effort and conduct more sample passes we propose converting our fish hauling boat into a dual fish hauler and electrofishing boat. This will allow us to sample more miles within a shorter period. To more efficiently sample pike we may reduce sampling intensity in low-yield pike reaches and increase sampling in high yield reaches. Pike and bass will be handled concurrently in the bass study reaches. Fish handling time will be reduced by subsampling lengths and weights of removed fish. To maintain data integrity, however, we will still measure all tagged or recaptured fish. Capture locations will be identified to the nearest 1/2 mile.

We will complete six passes throughout the study area during sampling for

northern pike. The first is a river-wide marking pass, during which all pike will be captured, tagged, and released. Five additional removal passes will be made. We will focus most effort during those passes in locations where pike were noted as the most abundant during the first sampling pass and where pike had high densities in previous years. Northern pike concentration areas typically contain few Colorado pikeminnow, so potentially harmful effects of repeated electrofishing will be reduced. Capture-recapture data from the first two sampling passes will be used to estimate abundance of pike in the study area. With this level of effort we hope to achieve about a 70% removal of pike, assuming flows are sufficient for us to complete the required number of sampling passes and that capture efficiency is relatively high (about 20%).

Smallmouth bass sampling will occur with pike sampling and will be focused in two main areas, a 24-mile reach in or around Little Yampa Canyon (one 12-mile treatment reach and one 12-mile control reach) and a 5-mile reach at the upper end of Lily Park. In Little Yampa Canyon, a total of ten sampling passes will be completed, which includes six of those described for pike sampling, plus an additional four. During the first pass, smallmouth bass will be marked and released in both control and treatment reaches. An additional nine removal sampling passes will be attempted in the treatment reach. In the control reach, smallmouth bass will be captured, tagged, and released on four sampling occasions, all of which will be done with pike sampling passes. Lily Park sampling for smallmouth bass will be done during pike sampling, with the first pass a mark and release pass followed by five removal passes.

In summary, pike sampling will be river-wide over six sampling passes. First-pass fish will be marked and released, fish on all subsequent passes will be removed. Smallmouth bass sampling will be restricted to the Little Yampa Canyon and Lily Park reaches. When river-wide northern pike sampling is in the smallmouth bass study reaches, smallmouth bass will be captured also. Smallmouth bass in the treatment reach of Little Yampa Canyon will be sampled 10 times (one mark and release, nine removal passes, six of those the same as for pike sampling). Smallmouth bass in the control reach of Little Yampa Canyon will be sampled a minimum of four times. Smallmouth bass in the 5-mile Lily Park reach will be sampled six times. First-pass fish will be marked and released, and fish on all subsequent passes will be removed.

Generally fish will be captured by electrofishing both shorelines concurrently. Off-channel habitats such as backwaters and flooded tributaries will be sampled with block and shock, seining, trammel nets, or fyke nets. Northern pike and smallmouth bass will be tagged with numbered Floy tags (Color = Yellow) and Colorado pikeminnow will PIT tagged per Recovery Program protocol. We will record tag data for recaptured fish tagged or marked by other agencies.

Northern pike removed from the river will be translocated to Yampa State Wildlife Area ponds and Loudy Simpson pond in Craig as identified by CDOW. Smallmouth bass will be moved to Elkhead Reservoir. If CDOW prefers to move fish to locations outside of the Craig-Hayden area, then we will transfer fish to CDOW staff in Craig, and they will provide transport to other locations. We will also collaborate with Pat Martinez, Aquatic researcher with CDOW, and if specified in the State collecting

permit we will provide him with smallmouth bass, northern pike and channel catfish for trophic ecology studies, stable isotope analysis, and stomach analysis.

We will cooperate and assist with Recovery Program or CDOW information and education efforts in the Yampa Valley. Primarily we will do this by providing information during informal contact with two important target groups: landowners near the river and anglers that fish the river or receiving waters.

Colorado Collecting Permit details:

1. Sampling will occur on the Yampa River and its tributaries in Moffat County, Colorado.
2. Sampling gear will include: electrofishing, seines, trammel or gill nets, fyke or hoop nets, angling.
3. Colorado pikeminnow and other endangered fishes will be PIT tagged per Recovery Program guidelines.
4. Northern pike and smallmouth bass will be tagged with Yellow Floy tags.
5. Northern pike that are removed will be transported and released in Loudy Simpson pond in Craig, Colorado, Yampa State Wildlife Area Ponds, or areas within a similar distance and identified by Colorado Division of Wildlife.
6. Smallmouth bass that are removed will be transported and released into Elkhead Reservoir or areas within a similar distance identified by Colorado Division of Wildlife.
7. Grass carp, walleye, and other rarely captured nonnative species will be handled per instructions from the Colorado Division of Wildlife.
8. Other native or nonnative species not mentioned above may be captured, examined, and released alive at site of capture.
9. Fish that are extremely injured when captured either due to natural causes or due to the capture event will be euthanized with an overdose of MS-222. Fish euthanized with MS-222 are not fit for human consumption.
10. Mortalities are typically rare. Mortalities will be documented on field sheets, their stomachs examined, and the carcass returned to the river. Meat will not be salvaged due to liability of inadequate sanitary conditions and extreme costs relative to minimal human value.
11. Some smallmouth bass and northern pike may be provided to CDOW researcher Pat Martinez for research purposes.

VII. Task Description and Schedule

Task 1	Dec-Jan	Prepare and present results at 2003 Recovery Program nonnative summit workshop and attend Researcher's Meeting 2004.

Task 2	Feb- Mar	Contact private landowners and obtain permission for property access for fish removal sampling. Attend agency and public meetings. Present 2003 results to DOW NW Region. Hire and train field crew; purchase and prepare and fabricate equipment.
Task 3	Apr - Jul	Yampa River sampling in Critical Habitat. Capture, remove and translocate fish.
Task 4	Aug - Nov	Equipment maintenance. Data entry and analysis. Prepare Recovery Program annual progress report. Interaction and data sharing with DOW aquatic researchers.

VIII. FY-2004 Work

Deliverables/Due Dates:

Recovery Program Annual Report: Nov 15, 2004

FY-2004 Work (for multi-year study)

FY-2004 Budget by Task

Task 1:	Researcher IV (1111/week-3 wks)	3333
	Researcher II (721/week- 3 wks)	2163
	Researcher II (721/week- 2 wks)	1442
	Travel (vehicle rental, lodging and per diem)	1600
	Total	8538
Tasks 2:	Researcher IV (1111/week-8 wks)	8888
	Researcher II (721/week- 8 wks)	5768
	Researcher II (721/week- 8 wks)	5768
	Travel (lodging and per diem)	1300
	Total	21724
Task 3:	Researcher IV (1111/week-16 wks)	17776
	Researcher II (721/week- 16 wks)	11536
	Researcher II (721/week- 16 wks)	11536
	Technicians 5 (623/week- 16 wks)	49840
	Travel (lodging and per diem)	14400
	Trucks (3) Lease	14800
	Truck mileage & expenses ($375 / truck/ trip)	6750
	Motor	6547
	Smith Root GPP 5.0 and associated gear	9644
	Boat Rigging for electrofishing capabilities	3150
	Boat gas (3) ($1000/boat/season)	3000

	Repair and maintenance of old boat	4250
	Field supplies	2485
	Floy tags for DOW to track moved fish (n=4000 @ $.50 ea)	2000
	Services (Welding, rigging, factory calibration of VVP)	2700
	Total	160414
Task 4	Researcher IV (1111/week-8 wks)	8888
	Researcher II (721/week- 8 wks)	5768
	Research Scientist (2 weeks)	3603
	Travel (lodging and per diem)	600
	Total	18859
	Sub-Total	209535
	CSU Overhead rate to BR (15%)	31430
	TOTAL	240965

Budget Footnotes:

1 Supplies include consumable items like nets, camping equipment, Safety Gear, and consumable field equipment.

2 The motor is necessary to update the fish hauling boat for dual use as a fish hauler and electrofisher. Motor costs include motor, jet unit, and gauges.

3 Electrofishing unit includes 5.0 Smith Root GPP, booms, stainless steel anodes and cathodes, safety railing, safety switch mats, rigging, and welding of booms and unit to boat.

4 One truck is required to trailer each boat, therefore we require at least three trucks. At least one truck must also contain a fish transport tank to move fish.

5 Services include long distance, cell phone, and outside labor costs such as boat rigging and tune ups, welding and factory calibration of Smith Root GPP 5.0 ($150) as required by Federal collecting permit.

6 Boat repair includes replacement, repair, and maintenance of parts used, broken, or damaged in previous years such as: throttle, steering, motor, jet sleeves and impellers and electrofishing assemblies. It also includes consumable supplies such as 2-stroke oil, grease, and maintenance parts.

FY-2005 Work (for multi-year study) Same as 2004, less ~$20,000 for boat and electrofishing equipment purchased in FY04 and addition of 4.5% estimated inflation rate for FY05.

IX. Budget Summary

	Project Cost
FY-2004	$ 240965
FY-2005	$ 227773

X. Reviewers: Biology Committee

XI. References

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Tracking
Filename = 04-06MYampa-Pike-SMB-sow.wpd

Revision dates:
1/09/04: Original draft based on recommendations from Nonnative workshop, 3–4 December 2003 and Biology Committee conference call, 23 December 2003.
1/22/04: Second draft, revised based on comments at Biology Committee meeting (1/15-16/04) and conference call (1/21/04) with Muth and Nelson (RIP), Pfeifer (FWS), Nesler (CDOW), and Bestgen and Hawkins (CSU). Purpose: explain details of pike and bass removals, how they coordinate, and reduce cost. Combine northern pike (Project 98a) and smallmouth bass (Project 125) SOWs to better explain coordination and cooperation between the two projects and to reduce costs.
2/13/04: Revised based on minor changes recommended during 1/29/04 Biology Committee conference call. Deleted "pike" from objective #3. Added information about Floy tag color. Fixed computational error for FY05 budget. Minor editorial corrections. Added sentence that we would record tag data for recaptured fish tagged or marked by other agencies.